New Valuation Method for Durability of Text Books

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Abstract

Although nowadays the use of the devices of electronic communication as an option is more and more frequently considered, school books have still remained the fundamental learning aids. But what is a durable school book like?

The article describes the test methods that the authors have determined for the description of the structural durability of school books. There were seven types of school books differing from each other in format and/or binding technology tested, and applied to model the book-using "'habits" of students; the results have been systematically arranged, and options have been determined for the improvement of durability properties.

In summary of the test results, it can be claimed that with respect to durability school books are made ideal when they are designed in smaller dimensions and with the smallest possible weight. It is better to have paperback covers, because during the performed tests hardcover books reflected more serious damage.

Introduction

Today, during the production of books nearly all the binding operations are performed with machines. These technologies have developed a lot in the past 5–6 decades, especially the so-called perfect binding techniques. They properly satisfy the demands relating to the general use of books.

It is primarily libraries that have had demands for so-called durable books, while this need has become increasingly stressed in the production of school books, too. In recent years, Hungary has particularly seen this issue associated with the

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quality properties of the so-called durable school books coming to the focus of attention. The fact that the need for durable school books has become important has been largely fostered by the government's effort launched in 2014 for the provision and distribution of durable school books. Requirements relating to school books (especially durable school books) are stipulated in Ministerial Decree 17/2014 (March 12) of the Ministry of Human Capacities. In terms of structural considerations and book binding, from among the provisions set out in the Decree it is only the so-called technological requirements that bring about harder tasks and challenges than before.

It is apparent that the Decree does not set out specific criteria, requirements in relation to the structural, mechanical properties of school books (durable books), the concept of durability.

Although the printing industry and the various research institutions associated with the printing industry apply well-known test techniques, methods and devices that are useful for determining the mechanical properties of a given book (mostly constituents) with respect to a specific requirements or even set of criteria, at the same time the methods for the evaluation of these test methods and the obtained results are not covered in any standardized, broadly accepted system. It means that generally accepted, objective methods and standards that would determine the mechanical and technological durability of bound books, and in particular the so-called durable books (library books and school books), on the level of definitions and substances are not available.

To promote the resolution of the issues listed above, our study has had the goal to elaborate quality indicators for durable school books, as well as define and model the properties of their durability.

Methods of the research

As it has been mentioned above, currently there is no uniform, generally accepted test method or standard that would specify the requirements in association with the examination and review of the binding quality of bound books, their durability, or the evaluation of the obtained results.

On the other hand, we are able to summarize the known test methods that are currently used for the verification of the binding quality of new, completed and bound books (Hyatt, 1988; Rebsamen, 2003, 2009, 2013).

The methodology for durability testing is in line with the evaluation proposed in the operating instructions of the MOFFETT UBT-9 (Universal Book Tester) equipment Figure 1.

Figure 1: *Moffett UBT-9 Universal Book tester*

Accordingly, 8 criteria are applied in durability tests to assess the extent of damage caused to the books, as indicated in Table 1.

Criterion 9 has been included in the list of examined properties under the recommendation of the researchers at the Institute of Media Technology and Light Industry, Óbuda University. The underlying reason is that the abrasion and turning up of the edge of the cover are important aspects in assessing durability.

Actions Produce the Following Results
1. abrasion of the shoulder of the spine
2. abrasions of the edges of the cover
3. light abrasion of the cover surface
4. distortion by impact
5. abrasion of the tail-cap and edges
6. hinge flexing action
7. breaking and tearing of the internal hinge
8. failure of sewn or adhesive bindings and splitting of the spine
9. abrasion and turning up of the edge of cover*

*Criterion of assessment recommended by the Institute of Media Technology and Light Industry, Óbuda University

Table 1: *Properties to be examined during the study performed with the UBT-9 durability tester*

For a single test piece, the duration of the durability test is 60 minutes (for the modelling of use for 4 years).

Suitability of the test pieces

For the evaluation of damage as per the properties listed in Table 1, a quantified evaluation method has been worked out.

As reflected in Table 2, a scale from 0 to 3 is used to evaluate the degree of damage by means of visual inspection. When the 40-minute testing time has elapsed, photos of the examined books are taken from the main perspectives in order to document the degree of damage.

Grade on the scale	Degree of damage	Evaluation properties: Acceptable degree of damage when the cover, binding and inner pages of the book are evaluated by means of visual inspection
0	No detectable damage	No visible damage and/or smaller abrasions can be seen on the surface of the cover (up to 4 abrasions), but they are not larger than 2 cm in any direction.
1	Minor damage	Larger, visible abrasions appear on the surface, but they are not larger than 4 cm in any direction. Visible crinkles on the inner pages. Minor impact-related distortions on the spine of the book. The corners of the cover are turned up.
2	Significant damange	Damage that still does not restrict usability, but causes aesthetic deficiencies. Worn surfaces in excess of 4 cm in length. Cracks can be seen on the cover and spine. The corners of the cover and the inner pages fold in. The spine of the book is considerably distorted. The sewing is loose.
3	Damage restricting usability	Damage restricting usability includes the ripping, discontinuity or detachment of inner pages, the disruption, detachment or break-off of the spine. Abrasions influencing legibility on the surface of the cover.

Table 1: *Properties to be examined during the study performed with the UBT-9 durability tester*

The qualification is performed based on tests that are conducted on three copies of the same book (test sample), by summarizing and calculating the average from the evaluation results of the nine criteria (Table 3).

Binding method	Soft-covered		Hard-covered	
	A4	B5	A4	B5
thread-stitched	x	x	x	x
thread-sealed	x	x	x	x
perfect bound with PUR	x	x	x	x
perfect bound with hot-melt	x	x	x	x
thread-stitched	x	x		

Table 3: *Types of the test samples*

Results

Due to the limitations of the extended abstract, only a part of the study will be presented. For paperback school books, durability tests assessing the conditions of the spine edges and corners, as well as binding conditions have been carried out. The other tests are conducted in a similar manner, and summed up in the conclusion.

Abrasion at the spine edges

From among the B/5 sized school books with perfect PUR binding, the school book with the 250 g/m2 cardboard cover and non-gloss foil coating (Figure 2) proved to be the best concerning the abrasion of spine edges.

Figure 2: *B/5 sized book showing the least abrasion on the spine edges*

The abrasion is hardly visible to the naked eye. The moderate damage is also due to the light, 230-gram weight of the book, as the book smashes against the sides of the machine with less power.

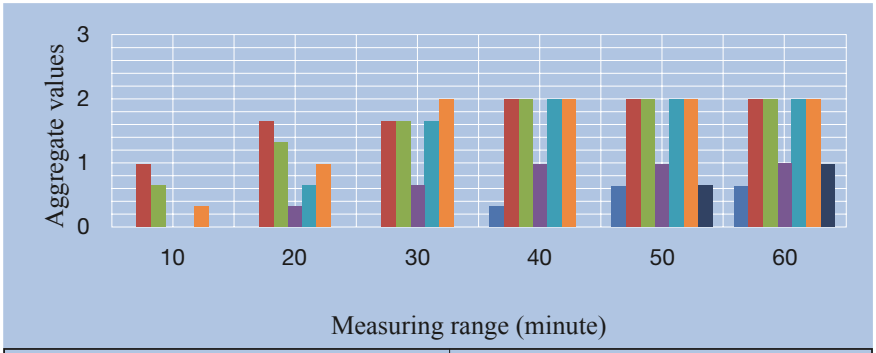
Similarly, from among the B/5 books the largest extent of spine abrasion has been suffered by the 496-gram school book (Figure 3) with perfect PUR binding.

Figure 3: *The largest extent of spine edge abrasion has been experienced for B/5 sized book No.10-12*

In the A/4 format, the best final result has been achieved by the 410-gram, thread-stitched school book (Figure 4). Its cover is of 260 g/m^2 weight. During the test, abrasion apparently occurred after the 50th minute, but it did not change drastically even by the end of the 60th minute.

The thread-stitched book proved to be the book with the worst spine edge. The weight of its cover is 260 g/m^2. It was thinner and more flexible than the most durable book, and therefore the book showed no rigidity in the test machine. It smashed against the walls of the chamber more easily, and due to their flexibility it more easily leant against the rounded corners, and therefore suffered abrasion over a larger area.

Figure 4: *A/4 format, No.25-27 thread-stitched school book with a considerable extent of spine edge abrasion*



PUR binding, No. 1-3, B5	PUR binding, No. 22-24, A4
Sewn binding, No. 4-6, B5	Sewn binding, No. 25-27, A4
PUR binding, No. 10-12, B5	Sewn binding, No. 28-30, A4
Sewn binding, No. 19-21, A4	

Figure 5: *Spine edge abrasion for paperback books*

In the light of the aggregated evaluation (Figure 5), it can be claimed that while initially the B/5 school book with perfect PUR binding showed strong abrasion, the spine edge abrasion of A/4- school books surpassed this extent of abrasion, and eventually even worse statistics could be obtained. It is also dependent on the type of the cover material and the weight of the book. In general, the worst type was the aurocard paper type in the case of large-format books. With respect to spine edge abrasion, smaller format books achieved better results.

Conclusion

In summary of the test results, it can be claimed that with respect to durability school books are made ideal when they are designed in smaller dimensions and with the smallest possible weight. It is better to have paperback covers, because during the performed tests hardcover books reflected more serious damage.

It has also been proved that it is reasonable to modify the test methods described in the referenced technical literature, because the recommended full testing time (60 minutes) that we have also applied is insufficient. In our experience – and it is also reflected in the results –, it is too short. Outcomes showing serious or total damage have occurred less frequently than expected.

Obviously, another conclusion that can be potentially drawn in view of the measured results, that the examined test books have had better than average quality in view of durability. Still, it can be true. Nonetheless, based on our studies this assumption cannot be scientifically confirmed.

The test method has to be refined in two respects. On the one hand, the damage time or intensity should be increased until total destruction so that clean-cut quality-related findings could be made in connection with the individual binding technologies. On the other hand, it is important to compare the accelerated destructive study with real-life use to see at what intensity the model examination can lead to the accessibility of the expected durability requirements. In this context, tests have already been conducted, and the associated results are still under processing.

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